CONFRONTING CLIMATE CHANGE – THE CHALLENGE OF ADAPTATION

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CREDENTIALS – WHO IS THIS GUY?

- Training in avian ecology
- Prior to 1990s researched mainly avian population ecology – shorebirds and seabirds
- Beginning about 1993 began working on effects of climate change
- Work funded by EPA, Pew, FWS, NPS, state agencies, etc.
- Now heading up Manomet's Climate Change Initiative
- Particularly interested in adaptation approaches

IMPACTS AND ADAPTATION

- Spent last decade thinking mainly about likely impacts on ecosystems

- We have fairly good idea of what is likely occur

- Emissions reductions are vital, but not a silver bullet

- We need to adapt!

DEER IN THE HEADLIGHTS?

- Conservationists and planners often glassy-eyed when adaptation comes up:
  - too big a problem
  - too distant in time
  - too much uncertainty
  - we already have our hands full

WE NEED TO MOVE FORWARD – TIME IS NOT ON OUR SIDE

- We cannot delay

- We need to focus scientific effort on adaptation options

- We need to use the science <u>that we have</u> to come up with usable conservation planning tools and solutions

- We need to focus on the needs of stakeholders (conservation agencies)

ADAPTATION QUESTIONS

- Which ecosystems/species/sites are more or less vulnerable to cc?
- Ecological trajectories under climate change?
- Roles of other stressors?
- How well will traditional conservation tools work in climate changed future?
- How do we avoid cures as bad as the illness?

MASSACHUSETTS ADAPTATION PROJECT

Logistics:

- Funding source – Doris Duke grant administered by Wildlife Conservation Society

- Timeline – 18 month project begun in April/May 2008. Will conclude in October/November 2009

- Collaborative – Manomet, DFW, TNC

CONSERVATION PLANNING - MASSACHUSETTS

- State has already developed (2005) Wildlife Action Plan (CWCS) – "roadmap" for future conservation of wildlife and habitat
- Identifies 22 critical habitat types and 257 animals in "greatest conservation need"
- Priority strategy – Proactive Habitat Protection
- CWCS acknowledges that climate change is likely to be major stressor – goes little further
- MA is way ahead of the game – most SWAPS do not address implications of CC

FOUR IMPORTANT ELEMENTS IN MA PROJECT

1. Detailed, fine-scale climate change analysis:

    - How much change in T and P?

    - Where will most change occur?

    - Hotspots?

    - Growing seasons?

    - Aridity?

FOUR IMPORTANT ELEMENTS IN MA PROJECT

2. Vulnerability analysis:

- which resources (e.g., habitats, species) most vulnerable?

- winners vs. losers?

- Trajectories?

- Non-climate stressors?

- Management options?

FOUR IMPORTANT ELEMENTS IN MA PROJECT

3. Tools to evaluate current and future investments/acquisitions:

- How will conservation values of current holdings alter?
- How do we evaluate long-term value of future acquisitions
- How do we identify priority acquisitions?

FOUR IMPORTANT ELEMENTS IN MA PROJECT

4. State involvement and "ownership"

MASSACHUSETTS ADAPTATION PROJECT

- Mass has State Wildlife Action Plan (SWAP)

- Focus is protection of important habitats

- Conservation road-map

- Mentions cc unlike most SWAPs

- This project aims to make SWAP "climate smart".

CONSERVATION PLANNING - MASSACHUSETTS

Questions:

1. Which of focal areas, target habitats will be most affected by CC?

2. How will conservation values of protected areas change under CC?

3. How will CC affect future land acquisition priorities?

4. How effective will conservation approaches be under CC?

5. How should we modify our tools and approaches?

CONSERVATION PLANNING - MASSACHUSETTS

Objectives:

- Develop tools to evaluate relative vulnerabilities of habitats, focal areas, species under CC

- Project impacts on protected areas under CC

- Provide information to focus habitat acquisition priorities

- Evaluate effectiveness of conservation approaches/strategies for most vulnerable resources under CC

- Develop alternative approaches/strategies to enhance resilience

OBJECTIVES

❖ Big Picture: to ensure that future conservation planning and implementation is "Climate-Smart"

❖ Determine how climate has changed in last century and how it will change in the next – fine spatial scale

❖ Map "exposure" and risk to important state resources

❖ Quantify vulnerabilities and likely trajectories of fish and wildlife habitats to climate change

❖ Build a GIS tool to support future acquisition decisions

PROGESS SO FAR – VULNERABILITY EVALUATION

Objective to evaluate the comparative vulnerabilities of fish and wildlife habitats

- Focus-group approach involving state habitat experts

WHY FOCUS GROUP APPROACH?

- We are projecting into the future
- Projections based on best current knowledge about climate change and Massachusetts habitats
  - ecology
  - current extents and change
  - threats
- "Ownership"

HABITATS BEING EVALUATED

Table 4. Habitat types evaluated.		
Forested habitats		**Freshwater wetland habitats**
Spruce-fir forest	C	Emergent marsh	C
Northern hardwood forest	C	Shrub swamp	C
Southern/central hardwood forest	C	Spruce-fir boreal swamp	C
Pitch pine-scrub oak forest	C	Atlantic white cedar swamp	C
Freshwater aquatic habitats		Riparian forest	P
Cold water Rivers and Streams	C	Hardwood swamp	C
Large cold water lakes	C	Vernal pools	C
Smaller cold water lakes and ponds	C	**Coastal habitats**
Cold water kettle ponds	C	Intertidal mud/sandflats	P
Warm water ponds, lakes and rivers	C	Saltmarsh	P
Connecticut and Merrimack mainstems	C	Dune habitats	P

FOCUS GROUP PROCESS

1. Habitat sub-groups formed (forests, wetlands, aquatic, coastal)
2. Provided latest information on future climates (2 scenarios)
3. Identified important variables that link climate change and ecosystems (elevation, cold-adapted, etc.)
4. Manomet developed preliminary sketch of likely vulnerabilities of each habitat
5. Sub-groups meet to review and comment on preliminary evaluations
6. Preliminary evaluations rewritten in light of sub-group comments
7. Evaluations to be submitted for final review to entire panel.

EMISSIONS SCENARIOS

- Doubling of CO_2 (LES)
- Tripling of CO_2 (HES)

Pre-industrial atmospheric CO_2 was 275ppm. Now at 390ppm – well on way to doubling.
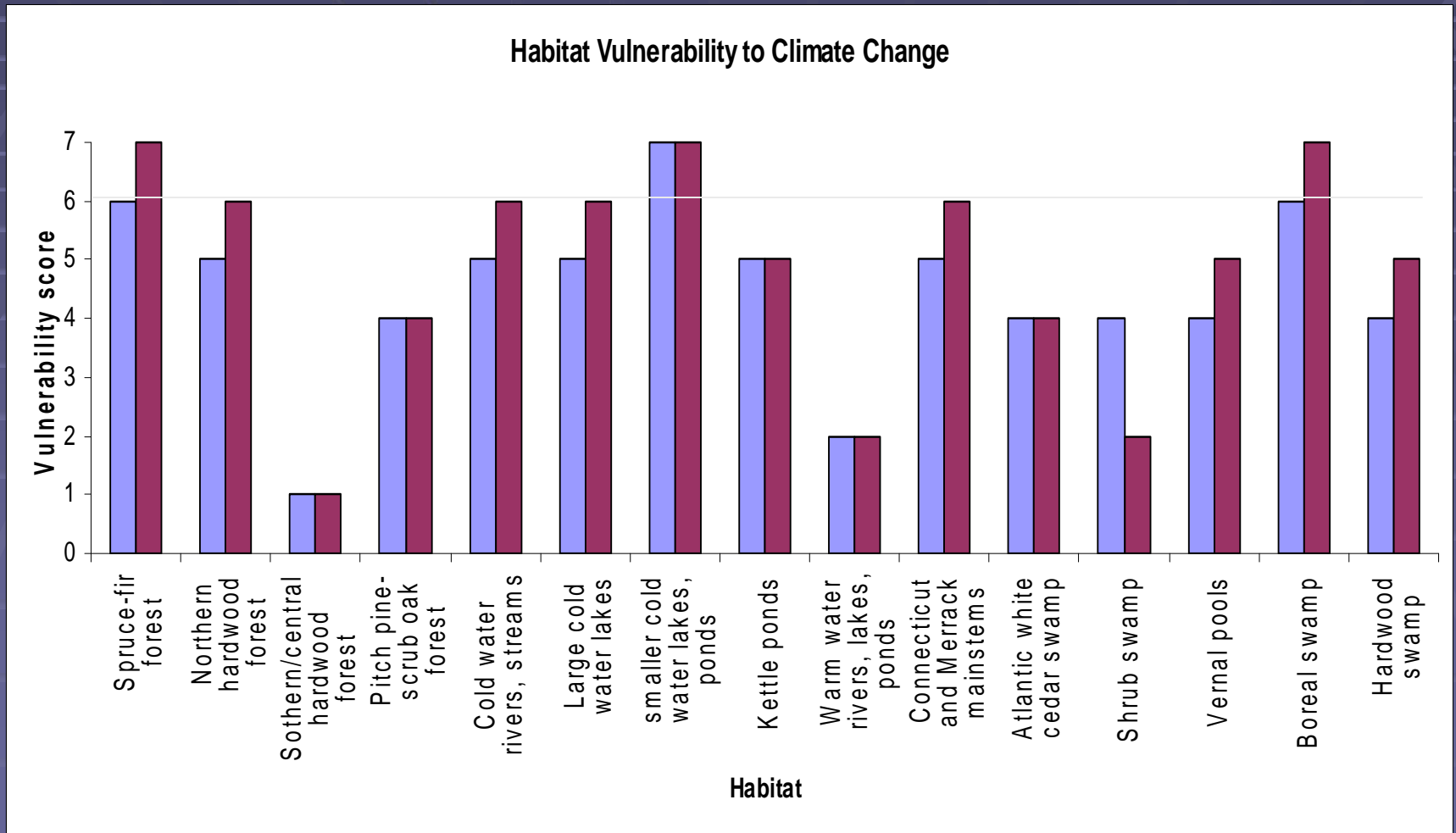
Vulnerability scores

Habitat likely to be eliminated entirely 7

Majority of habitat likely to be eliminated 6

Extent will be reduced but by <50% 5

Extent may not change appreciably 4

Habitat may become established 3

Habitat may expand moderately (<50%) 2

Habitat extent may expand greatly 1

CONFIDENCE?

Three confidence scores (modified from IPCC):

High   >70%

Medium   30-70%

Low   <30%

VULNERABILITY RANKINGS

Habitat Vulnerability to Climate Change

VULNERABILITY FACTORS

Habitat	Cold-adapted	High elevation	Northern habitat	Southern habitat	Low elevation	Fire-vulnerable	Pest outbreaks
Spruce-fir	XX	XX	XX			XX	XX
Boreal swamp	XX	XX	XX			XX	X
Coldwater lakes	X	X	X				
Northern hardwood	X	X	X				X
Coldwater rivers	X	X					
Pitch pine scrub-oak				XX	X	Dependent	
Atlantic white cedar				XX	XX	Dependent	
Central/southern hardwoods				XX	XX	Tolerant	
Warm water aquatic				XX	XX		

CONFIDENCE SCORES

	Vulnerability Score			
	4	5	6	7
High			Northern hardwoods	Spruce-fir forest Boreal swamp Cold water rivers and streams Cold water lakes and ponds
Medium	Atlantic white cedar Shrub swamp	Hardwood swamp	Large cold water rivers and lakes Merrimack and Connecticut mainstems	
Low	Pitch pine-scrub oak	Vernal pools		

Future Acquisitions

- Reactive – we need an approach to evaluate change in conservation values of existing holdings

- Proactive – we need an approach to help us identify and target future acquisition priority areas

- We need a "predictive tool" that will complement existing prioritization
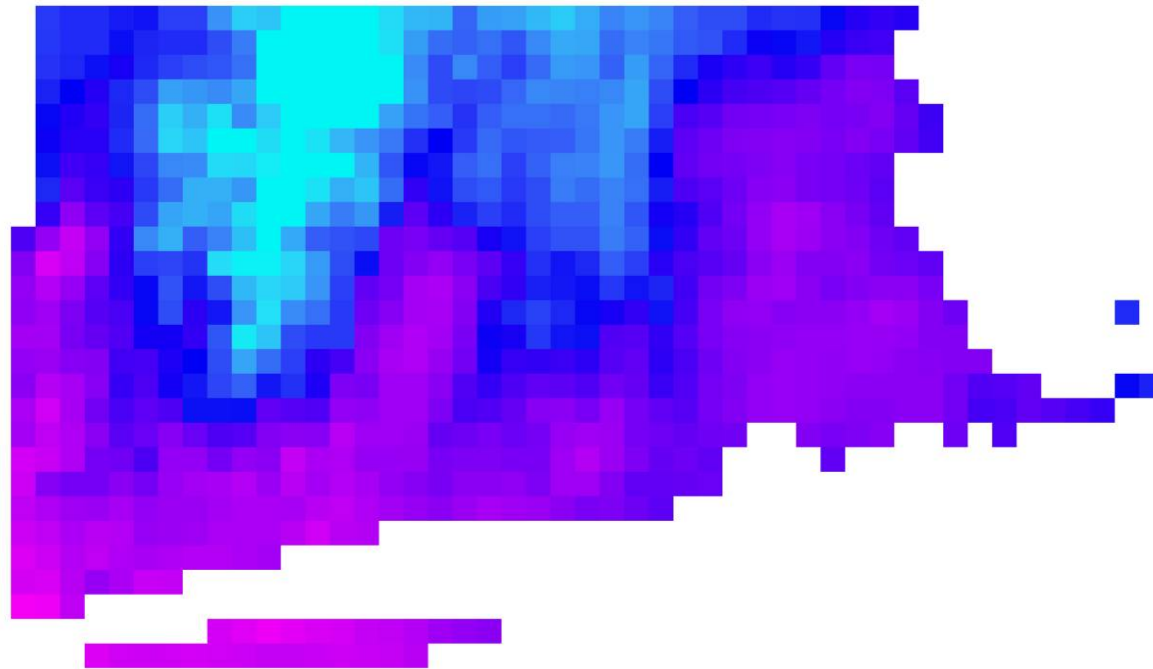
Future Acquisitions

Main approach will be to combine on GIS platform:

- current habitat/priority area distributions
- vulnerability results and expected change
- projected patterns of future climate change
- projected responses/changes
- ownership data
- other stressors – intervention points
- etc.

Provides spatial model of climate change exposure and risk of habitats

FUTURE ACQUISITIONS - CLIMATE WIZARD

- Web-based tool developed by The Nature Conservancy
- Provides practitioners with ability to:
  - backcast, empirical data from monitoring stations
  - project climate, three downscaled General Circulation Models, three emissions scenarios
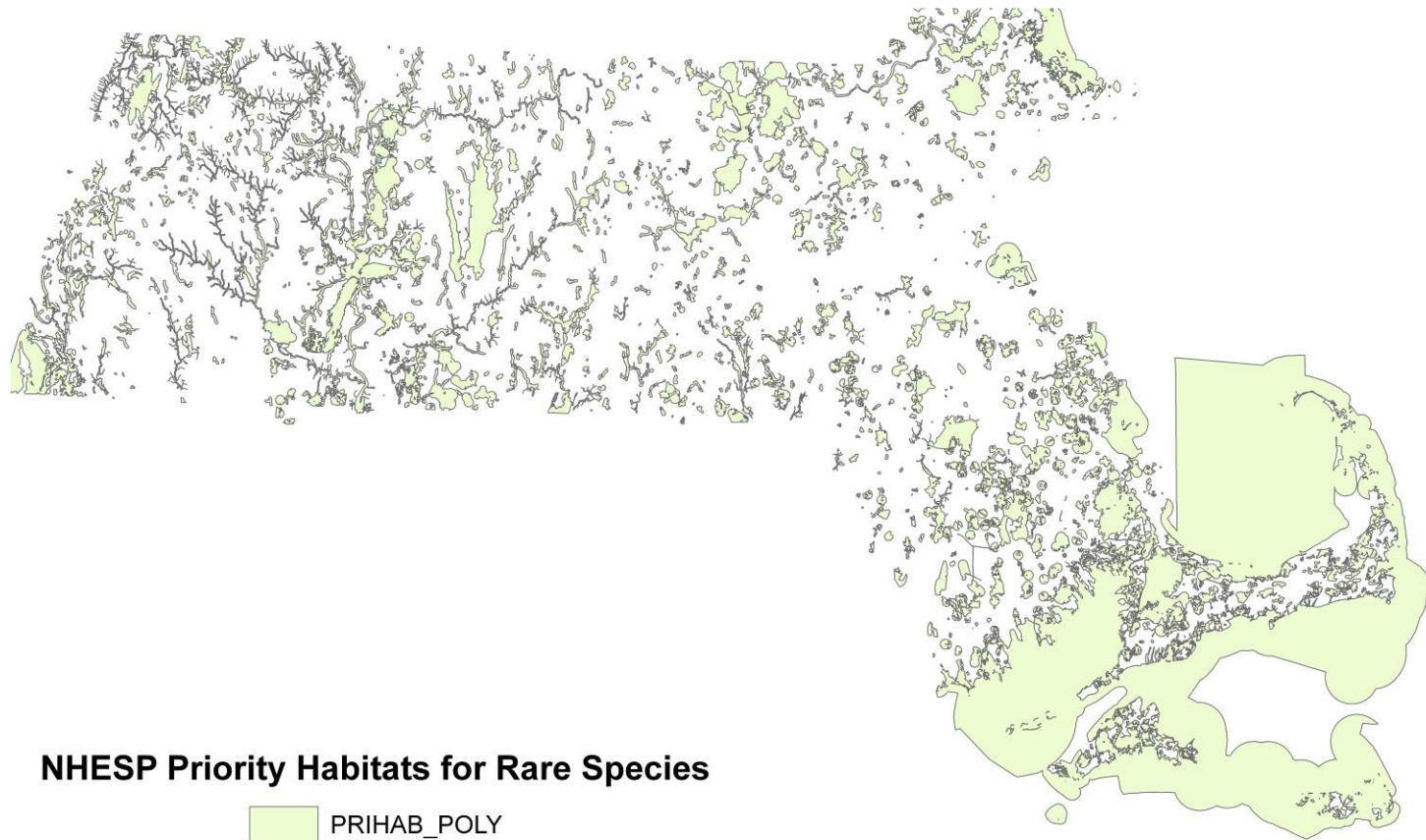
Legend

mean_northAm8k_tmax_14_1970_1990.asc

Value

High : 16.588570

Low : 10.210480

The Nature Conservancy, Climate Wizard

NHESP Priority Habitats for Rare Species

PRIHAB_POLY

Natural Heritage and Endangered Species Program

MOVING FORWARD

- We need to begin developing APs ASAP, time is not on our side.

- We cannot wait for the science to get better

- There are adaptation measures that we can be implementing now

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